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A SUMMARY OF STUDIES IN ACHIEVEMENT OF VOCATIONAL AGRICULTURE GRADUATES IN COLLEGE.

BY- MCCLELLAND, JOHN B.
IOWA STATE UNIV. OF SCIENCE AND TECH., AMES
IOWA STATE DEPT. OF PUBLIC INSTR., DES MOINES

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TWENTY-SEVEN STUDIES ARE INCLUDED IN THIS SYNTHESIS OF RESEARCH ON THE APPROPRIATENESS OF HIGH SCHOOL VOCATIONAL AGRICULTURE STUDENTS GOING ON TO AGRICULTURAL COLLEGES. MOST OF THE STUDIES INVOLVED STATISTICAL SIGNIFICANCE TREATMENT. THE STUDIES ARE ORGANIZED INTO SECTIONS--(1) COMPREHENSIVE, (2) ACHIEVEMENT IN LEADERSHIP ACTIVITIES, (3) SCHOLASTIC ACHIEVEMENT IN VARIOUS COLLEGES, (4) OVERALL SCHOLASTIC ACHIEVEMENT IN COLLEGES OF AGRICULTURE, AND (5) ACHIEVEMENT IN BASIC SCIENCE COURSES, AGRICULTURAL ENGINEERING COURSES, AND OTHER AREAS OF TECHNICAL AGRICULTURE SUCH AS POULTRY SCIENCE, THE DAIRY INDUSTRY, ANIMAL SCIENCE, AND AGRONOMY. THE SIGNIFICANCE OF THE FINDINGS RELATIVE TO ENROLLMENT, EDUCATION, EMPLOYMENT, AND COLLEGE ACHIEVEMENT IS DISCUSSED. FORMER STUDENTS OF VOCATIONAL AGRICULTURE DO AS WELL OR BETTER THAN THOSE WITHOUT VOCATIONAL AGRICULTURE IN AGRICULTURAL COLLEGES. THERE WAS SOME INDICATION THAT VOCATIONAL AGRICULTURE STUDENTS WHO TOOK LESS THAN THE AVERAGE AMOUNT OF SCIENCE AND MATHEMATICS IN HIGH SCHOOL HAD MORE DIFFICULTY IN SOME BEGINNING COLLEGE COURSES THAN THOSE WHO TOOK MORE THAN THE AVERAGE AMOUNT. HOWEVER, THE STUDENTS WHO HAD VOCATIONAL AGRICULTURE IN HIGH SCHOOL DID BETTER IN SOME BEGINNING COLLEGE AGRICULTURAL COURSES AND BOTANY. VOCATIONAL AGRICULTURE GRADUATES SEEMED TO PARTICIPATE MORE IN LEADERSHIP ACTIVITIES IN COLLEGE AND RURAL COMMUNITIES THAN NONVOCATIONAL AGRICULTURE GRADUATES. (JM)

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*A Summary of Studies*

*In*

# ACHIEVEMENT OF VOCATIONAL AGRICULTURE GRADUATES IN COLLEGE

*John B. McClelland*

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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# FOREWORD

Increasing numbers of graduates from the curriculum in vocational agriculture, as well as from other high school curricula, enroll in agricultural colleges or in other colleges before entering full-time employment. No doubt, this trend will continue because the educational and other qualifications for success are becoming higher in agricultural occupations, including farming, just as qualifications are becoming higher in non-agricultural fields of employment. Any evaluation and any replanning of the vocational agriculture program should include an investigation of the extent to which the curriculum is meeting the needs of graduates who decide to enroll in college as well as the needs of those who enter an occupation directly after graduation.

This report includes summaries of 27 studies of the achievement in college of former students of vocational agriculture. Of the 27 studies, 16 were conducted in Iowa by graduate students under the direction of faculty members in the Department of Education at Iowa State University and were accepted as masters theses or doctoral dissertations. A number of the recent studies were conducted as part of the Iowa Agricultural Experiment Station Project Number 1253. Reference is also made in this summary to some related studies that were directed in Iowa and in other states as staff studies by college personnel as well as by graduate students.

C E Bundy

# ACHIEVEMENT OF VOCATIONAL AGRICULTURE GRADUATES IN COLLEGE[1]

## INTRODUCTION

An analysis of the achievement in college of students who have been enrolled in vocational agriculture as compared with the achievement of students who have taken other curricula in high school is of interest to persons concerned with the improvement of education at both the high school and college levels. Information about the achievement of high school graduates in college is needed by persons concerned with the organization of the program in vocational agriculture, with guidance and counseling of high school students, with placement, and with evaluation of high school educational programs.

Also, information about the achievement of vocational agriculture students in college is needed by administrative officials and faculty members in agricultural colleges and other colleges. The information should be considered in the determination of admission policy, in the selection of courses to be offered in certain college curricula, in the determination of content of courses, and in the guidance of college students in the selection of curricula and courses.

The question is frequently asked whether the curriculum in vocational agriculture should be elected by students who plan to enroll in a college of agriculture or in some other college. It is generally agreed that major objectives of vocational education in agriculture at the high school level include the development of the agricultural competencies needed by persons preparing to engage in farming or in off-farm agricultural occupations, and the development of the ability to secure satisfactory placement and advancement in such occupations.

Studies have shown that in Iowa a majority of graduates of the program in vocational agriculture enter farming or some other kind of gainful employment, including military service, immediately after high school graduation instead of enrolling in college or in some other full-time educational institution. However, a fairly high percentage of vocational agricultural graduates do enter college and hence attention is being given to the extent to which their needs are being met.

### Vocational Agriculture Graduates in College

At the request of the Chief, Agricultural Education of the Iowa Department of Public Instruction, teachers of vocational agriculture in Iowa made a follow-up study of students who had been graduated from this curriculum in the spring of 1964. This study disclosed that 535, or 27.5 per cent, of the 1,942 students who had been graduated from departments of vocational agriculture that spring were enrolled for full-time instruction in colleges or other educational institutions within six months after graduation. (13)

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[1]Prepared by John B. McClelland, Professor of Education, Iowa State University.

As might be expected, the percentage of all high school graduates who continue their education is much higher than the percentage of vocational agriculture graduates who do so. A report of the Iowa Department of Public Instruction, cited in the February, 1965 newsletter of the Iowa Consultant in Agricultural Education (12), disclosed that 57 per cent of the 33,044 boys and girls who were graduated from all Iowa high schools in the spring of 1964 were enrolled full-time in college or in some other educational institution in the fall of that year. Of all Iowa high school graduates that year, 43 per cent were enrolled in colleges or junior colleges and 14 per cent were in some other full-time educational program.

It is apparent from the aforementioned data concerning high school graduates that vocational agriculture graduates constitute only a relatively small percentage of all male high school graduates who might be regarded as prospective students for colleges of agriculture. However, Associate Dean Thompson of the College of Agriculture, has pointed out that about one half of the entering freshmen in agricultural curricula at Iowa State University during recent years had studied vocational agriculture in high school (39).

Recent studies in Missouri, Nebraska, and Wisconsin have shown that the percentage of agricultural college students who had been enrolled in vocational agriculture were approximately the same as in Iowa. However, in an Illinois study, Krebs (24) found that 71.4 per cent of 836 male students who had entered the College of Agriculture in that state during 1954 through 1957 had submitted one or more entrance units in vocational agriculture.

## Evaluation of Vocational Agriculture

Studies of achievement in college of former students of vocational agriculture may be regarded as an evaluation of the extent to which this high school program is meeting the needs of graduates who decide to continue their education in college. In this connection information is of interest concerning the number of studies which have been reported involving evaluations of various objectives of the vocational agriculture program.

In Table 1, a classification is given of 593 evaluation studies which have been made throughout the United States and reported to the Research Committee of the Agricultural Education Section of the American Vocational Association. Of the 593 studies involving an evaluation of vocational agriculture, 48 were concerned with the achievement of vocational agriculture graduates in college. Graduate students at Iowa State University completed 16 or one third of the 48 studies that have been reported in this area of investigation. Eight of the studies were accepted as doctoral dissertations. Most of the others were masters' theses. A few were staff studies.

The relatively high percentage of vocational agriculture graduates who decide to enroll in college and the high percentage of college of agriculture students who were enrolled in vocational agriculture in high school are indications of the importance of the studies which are summarized in this report.

Table 1. Studies reported throughout the United States that involved an evaluation of vocational agriculture, 1917-1964.[a]

| Classification | Number of Studies |
|---|---|
| Follow-up and placement of former students | 298 |
| Methods of instruction | 126 |
| Farming programs of students | 77 |
| Achievement in college of former students | 48 |
| Other evaluation studies | 44 |
| Total | 593 |

[a]Studies in agricultural education reported from 1917 to the 1962-63 school year have been summarized in a series of bulletins published by the U.S. Office of Education (45). The titles of studies reported through the 1963-64 school year were given in a mimeographed list prepared by the Research Committee of the Agricultural Education Section of the American Vocational Association.

This report includes a summary of each of the three Ph.D. dissertations and the thirteen M.S. theses concerned with achievement of vocational agriculture graduates in college which have been completed in Iowa. It includes summaries of each of the five doctoral studies in this subject area which have been reported from other states.

Also included in this report are brief summaries of three studies by Master's candidates and four investigations by agricultural education staff members in other states. References are made to certain findings in these seven studies that appear to be of special interest in connection with findings of Iowa studies and of doctoral studies in other areas.

## SUMMARIES OF STUDIES OF ACHIEVEMENT OF VOCATIONAL AGRICULTURE GRADUATES IN COLLEGE

Several studies have been made of achievement in college of students who had been enrolled in high school curricula in various areas of vocational education or in experimental programs as compared with achievement of graduates of the usual college preparatory or general curriculum. The 16 Iowa studies of achievement in college of former students of vocational agriculture were limited to scholastic achievement. However, a few of the 48 studies concerning achievement of vocational agriculture graduates which have been reported throughout the United States have included some indication of the extent of participation in leadership activities in college.

Some of the studies of scholastic achievement of former vocational agriculture students were concerned with the overall achievement in various colleges of a university. Some studies were limited to achievement in a college of agriculture. Others were limited still further to achievement in a particular subject matter area, or a particular class.

### Comprehensive Studies

The findings of studies of the achievement in college of students who had been enrolled in various types of vocational and experimental high school programs as compared with the achievement of graduates of the traditional college preparatory curriculum are of interest in connection with the present topic. Kearney and Cook (22) in an article on the high school curriculum in the Encyclopedia of Educational Research stated that the Eight-Year Study by the Commission on the Relations of Schools and Colleges of the Progressive Education Association, which was reported in 1942, resulted in a modification of curriculum theory and practice. According to Kearney and Cook, the conclusion was reached in this study of 30 schools, that the traditionally prescribed content of the secondary school curriculum was not as conducive to good college work as had been assumed.

The Eight-Year Study included a comparison of the achievement in college of 475 matched pairs of students. The achievement of the graduates of the 30 schools in this study, which provided various types of "progressive" curricula, was compared with that of graduates who had taken the traditional college preparatory curriculum and subjects.

According to a summary of the Eight-Year Study by Wallen and Travers (46) in the Handbook of Research in Teaching, the graduates of the 30 "progressive" high schools earned a slightly higher total grade average in college and received slightly more academic honors than the students who had followed the traditional curriculum. The two groups of college students were also compared in some 60 separate areas including extent of participation in organized activities and leisure time interests. The students who had not followed the traditional curriculum participated more in student group activities and earned a higher percentage of nonacademic honors.

Wenrich (47), in the Encyclopedia of Educational Research, referred to a number of studies which compared achievement in college of students who had been graduated from curricula in various areas of vocational education. He stated that there is no evidence that students who took vocational curricula in high school would have been more successful in college if they had taken college preparatory sequences.

## Achievement in Leadership Activities

The objectives of the program in vocational agriculture include the development of those abilities in human relationships needed to assume leadership responsibilities in such activities (43). The development of these abilities is stressed in the program of the Future Farmers of America, the national organization of vocational agriculture students.

No studies have been reported in Iowa that were concerned primarily with the participation of former students of vocational agriculture in extracurricular activities in college, or the extent of their leadership in such activities. However, three studies that were made in other states included some findings concerning such activities.

At the University of Wisconsin, Pumper (32) in his M.S. thesis, investigated the records of 737 new freshmen students who had entered the College of Agriculture during the period of 1952 through 1956. Of the vocational agriculture graduates included in his study, 10.9 per cent had been elected to Alpha Zeta; whereas, only 5.1 per cent of the nonvocational agriculture graduates had been elected to this honorary agriculture fraternity. The fraternity stresses leadership ability as well as scholarship and other qualifications in the selection of members.

Kennedy (23) in his M.S. thesis at Washington State University, investigated the relationship between participation in vocational agriculture programs in high school and student leadership in the University. He designated as leaders 268 students who had been presidents of men's organizations on the campus for the school years 1957-58 through 1959-60. A 10 per cent random sampling of all male students at Washington State University who were not presidents of groups during the three-year period provided a control group of 414 students who were designated as nonleaders.

Kennedy found that 30.9 per cent of the student leaders had studied vocational agriculture in high school an average of 3.3 years. Only 13.3 per cent of the nonleaders had received any vocational agriculture training. Kennedy also investigated the number of high school credits earned in specific areas of studies such as English, science, mathematics, and foreign language. The only significant difference between the two groups with respect to the high school courses taken was that vocational agriculture students had taken less foreign languages.

## Extracurricular activities

In his M.Ed. essay at Cornell University in 1961, Macomber (26) reported performance comparisons between two groups of students in the College of Agriculture at Cornell. His sample consisted of 50 students who had taken two or more units in vocational agriculture and 50 students who had not had courses in this subject in high school. These students were paired on bases of scholastic aptitude, amount of farm experience, and year of enrolling in Cornell University.

Macomber found little or no differences between the two groups in the extent to which the students had engaged in extracurricular activities in college, in the number of scholarships earned, or in the number who had been graduated, transferred, or dropped out of college. The small differences that he found in average grades of the groups in the mathematics-science area and in technical agriculture were not found to be statistically significant when the t-test of significance was used.

## Scholastic Achievement in Various Colleges

Various methods of measuring scholastic achievement have been used in studies of the relationship of enrollment in vocational agriculture to scholastic accomplishment in college. Some studies involved a comparison of the cumulative averages of marks in all courses at the time of graduation or at the end of certain quarters. Others involved averages of marks in particular course areas or in particular classes. In a few studies comparisons were made of the numbers of students who had entered with the numbers who had been graduated or who had been re-enrolled in the institution in certain quarters.

### Iowa Studies

Three Iowa studies have provided information concerning scholastic achievement of former students of vocational agriculture in various colleges rather than in one particular college.

The first of the studies reported in Iowa concerning achievement in college, of vocational agriculture graduates was McCalley's M.S. thesis (27). It was completed in 1930 and provided information concerning 246 former students of vocational agriculture who had entered Iowa State University and 35 who had entered the State University of Iowa from 1919 through 1928. The former students in his groups had submitted two or more entrance credits in vocational agriculture. Of the 246 vocational agriculture graduates who had entered Iowa State University during that period, 67 per cent had enrolled in agriculture, 21 per cent in engineering, 7 per cent in veterinary science, and 4 per cent in industrial science (now the College of Science and Humanities).

McCalley found that the average scores of the former vocational agriculture students in scholastic aptitude tests was lower than the average scores of all entering students. However, the average of the marks of the former vocational agriculture students in all college courses was slightly higher, although probably not significantly higher, than the average marks of all male students in the University.

A comparison of the average marks in animal husbandry courses and in first-year mathematics courses showed that the former vocational agriculture students in McCalley's study also had slightly higher average marks in both of these areas than the averages of all students in the same college courses. In English courses, the percentage of former vocational agriculture students demoted was somewhat greater than the percentage of all students demoted.

During the period included in McCalley's study, 25 of the 35 former students of vocational agriculture who had entered the State University of Iowa had enrolled in liberal arts. The others were distributed in eight areas including 1 in law, 2 in medicine and 2 in engineering. The average of the marks in all college subjects of the 35 former students who were enrolled in the University was .23 points lower on the 4-point marking scale than the average of all students in the University.

In 1958 Lathrop (25) in his Ph.D. dissertation examined the scholastic achievement of a sample of 1516 freshmen students who had entered four colleges of Iowa State University in 1952. His classification of seven high school course patterns included an agriculture pattern consisting of students who had taken 3 or more units in vocational agriculture.

Lathrop found upon combining the records in all colleges of the University except Veterinary Medicine that the students in the mathematics-science pattern (a total of 6 or more units in high school mathematics and science) had the best chance of remaining in college beyond the first quarter. However, the influence of the high school pattern was, to a large extent, minimized as the student continued his college career.

Even in engineering Lathrop found that when the American Council of Education (ACE) scholastic aptitude scores and the high school averages were held constant, the high school pattern of courses had little influence on graduation-attrition tendency or cumulative quality point averages at the end of a five-year period.

In agriculture, Lathrop found that the high school curriculum pattern which included a total of 6 or more units of mathematics and science seemed to have a favorable influence on first quarter survival-attrition tendency. However, the high school pattern seemed to have little influence on the first quarter quality point average and no appreciable influence on either graduation-attrition or cumulative quality point average at the end of a five-year period. Lathrop found that the student suffered no appreciable penalty because of the size of the high school from which he had been graduated other than that reflected in the pattern of courses.

Hensel (19), in his doctoral dissertation at Iowa State University, investigated the relationship of courses taken in high school and other variables, to the scholastic achievement of students in four colleges at Iowa State University. The 2013 students whose records were used in the study had entered the University in the fall quarter of 1955. The study was completed in 1962.

Of the 16 variables that were examined by Hensel, those which were found to be most highly correlated with scholastic achievement were the high school grade point averages, the English placement test scores, and the mathematics

placement test scores. When the other 13 variables, including the semesters of high school course work in vocational agriculture and in 8 other high school subject areas were added one at a time to the three-variable regression equation it was found that no four-variable equation gave any appreciable advantage over the regression equation using the three aforementioned variables.

Hensel stated that the number of semesters of certain high school courses such as mathematics and science appeared to have a positive but variable correlation with achievement in the various colleges. He recommended that further study be made of high school course backgrounds as related to student achievement in specific colleges at the University. Some information concerning this point is provided in later sections of this report.

Studies in Ohio and Georgia

At Ohio State University, Pierce (31) in his Ph.D. dissertation, which was completed in 1960, studied the records of 800 male students who had entered five undergraduate colleges of the University from 1946 to 1955. Of these students, 400 with vocational agriculture backgrounds and 400 without such experience were pair-matched on the bases of the Ohio State Psychological Examination scores and age. A random sampling procedure was used.

The former vocational agriculture students in the Ohio State University study had taken an average of 1.9 years of high school mathematics; whereas, members of the nonvocational agriculture group had taken 2.5 years, or about one semester more of course work in mathematics. However, the former vocational agriculture students had taken only slightly less years of high school courses in chemistry, physics, and English than the students in the nonvocational agriculture group.

Pierce found that the mean twelfth quarter cumulative quality point averages for members of the vocational agriculture and the nonvocational agriculture groups respectively were as follows: (1) in all five colleges, 2.63 and 2.51; (2) in the agricultural college, 2.66 and 2.58; and (3) in the four nonagricultural colleges, 2.59 and 2.41. Although the differences were slightly in favor of the vocational agriculture group in each of these three comparisons, none was significant at the 1 per per cent level. Also, no significant difference at the 1 per cent level was found between the mean marks of students with and without vocational agriculture in 19 selected subject areas in the agricultural college.

In a staff study at the University of Georgia, O'Kelley and Lester (30) investigated the marks earned during the first year by male students who had entered the university in the 1960-61 school year and who had completed three quarters of work. The vocational agriculture group received significantly lower mean verbal and mean mathematics scores than the nonvocational agriculture group in the College Entrance Examination Board tests.

In spite of the difference in the C.E.E.B. test scores, no statistically significant differences were found in the Georgia study between the groups with and without vocational agriculture in the marks received during the freshman year in the University or in the College of Agriculture. Also, there were no significant differences in mean marks received in specific college courses investigated including English, Mathematics, chemistry, physics, botany, zoology, economics, and political science.

## Overall Scholastic Achievement in Colleges of Agriculture

A large proportion of the studies which have been reported concerning achievement in college of vocational agriculture graduates have been limited to achievement in colleges of agriculture, or in subjects which are usually included in the curricula in colleges of agriculture. This has been true of studies which have been reported from other states as well as of Iowa studies.

### Iowa studies

In his M.S. thesis in 1947, Bicknell (6) studied the records of 337 freshmen students who had enrolled in agriculture at Iowa State University in the fall quarter, 1946. The students were classified into two groups: Those who had taken vocational agriculture and those who had not. He stratified into veteran and nonveteran groups, and by multiple regression made allowances for individual differences as indicated by the American Council on Education Psychological Examination (ACE) scores and high school averages.

Bicknell found that on a basis of the first quarter quality point averages, the students who had taken vocational agriculture had a significant advantage. He concluded that there were some factors other than college aptitude as measured by the ACE test and high school marks which tended to make former students of vocational agriculture more successful than other students in courses taken by freshmen in agriculture at Iowa State University.

In 1950, in his Ph.D. dissertation, Bicknell (5) made an evaluation of various high school subject matter patterns submitted by 997 male freshmen students who had entered agriculture at Iowa State University during the fall quarters of 1946 through 1948. The achievement of these students was measured in terms of (1) the quality point averages earned in courses in agriculture subjects their first quarter; (2) marks received in the initial course in chemistry; and (3) re-enrollment beyond the freshman year.

The entering students were classified into four high school pattern groups: (1) vocational agriculture students--3 or more units; (2) other vocational students--6 or more units; (3) mathematics-science students--any combination of 6 or more units; and (4) general pattern students. The groups were stratified according to the year of entering college and farm or nonfarm background.

Statistical procedures included controls with the American Council of Education Psychological Examination scores, and first quarter English marks.

Bicknell found that the vocational agriculture pattern gave the best preparation and the general pattern the poorest preparation for achievement in the College of Agriculture as measured by the quality point average earned in agricultural subjects taken the first quarter. He found that students who had taken the mathematics-science pattern of courses in high school had received significantly higher first quarter chemistry marks than students who had taken the other patterns. However, he pointed out that a larger proportion of the mathematics-science group may have studied chemistry in high school than other groups. If so this might have resulted in the higher marks in chemistry. Bicknell stated that insofar as the various high school pattern groups could be evaluated in terms of their attrition (re-enrollment) ratios, the mathematics-science group was found to be apparently the most effective. The other three pattern groups appeared to be equally effective when compared on a basis of attrition ratios.

Schmidt (34), in his M.S. thesis at Iowa ate University, analyzed the records of 287 male students who had entered the College of Agriculture in the fall of 1955. His study was completed in 1961. He found a negative relationship between the semesters of vocational agriculture and the semesters of high school science submitted as entrance credits. However, there was a positive correlation significant at the 1 per cent level between the first-quarter quality point averages and the semesters of vocational agriculture, and also between the final college quality point averages and the amount of vocational agriculture. No significant relationships were found between either the first quarter or the final quality point averages and the semesters of science taken in high school.

Schmidt concluded that high school vocational agriculture apparently had more to do with a high quality point average than the semesters of science taken in high school. His findings tend to support the recommendation in the suggested vocational agriculture program (Appendix I) for students who may enter a college of agriculture; namely, that the student omit either high school general science or biology but take both physics and chemistry.

Studies in other states

In 1960, Smith and Baird (35) reported a University of Maryland staff study which involved a review and summary of 102 items of research on achievement of vocational agriculture graduates in colleges of agriculture. According to the authors, the studies reviewed did not reveal that any one curriculum had been superior to others in preparing students for academic success in colleges of agriculture. Also, they stated that vocational agriculture courses had contributed to the preparation of students for success in colleges of agriculture equal to the contribution of other high school courses.

In the Agricultural Education Magazine of February, 1960, Tom (40) summarized findings from 32 studies which dealt with various aspects of

college success of former students of vocational agriculture. He concluded from the results of these studies that students who take vocational agriculture in high school generally do as well or better in colleges of agriculture than do students not taking vocational agriculture and that vocational agriculture seems to be equal to other high school programs as preparation for college.

Krebs (24), of the University of Illinois staff, in 1961 reported a nonthesis study of the college success of students enrolled in the College of Agriculture. His study included 836 male students who had enrolled as freshmen during 1954 through 1957. No significant relationship was found between units of credit in high school vocational agriculture and scholastic aptitude. However, he found that students with the most credit in vocational agriculture tended to earn slightly higher average marks in college than the students with little or no credit in this subject. The loss of students from the College of Agriculture was least for the group of students who had taken the most vocational agriculture in high school.

Both in mathematics and in science, Krebs found significant positive relationships between units of high school credit in each subject and scholastic aptitude. However, in spite of the aforementioned relationships, he found no significant relationships between units of credits in high school mathematics or in science and grade point averages in the College of Agriculture.

In his Ph.D. dissertation, which was completed in 1958 at the University of Minnesota, Hanson (18) investigated the relationship between the levels of preparation in high school vocational agriculture, science, and mathematics and achievement in the College of Agriculture. His sample consisted of 395 students who had enrolled during the fall of 1954 through the fall of 1956 and who had completed one year of college work. His statistical treatment included the use of analysis of variance, covariance, and the multiple range test. No significant differences were found between high school pattern and quality point averages in all courses taken in the college of agriculture or in agriculture courses either at the end of the first quarter or the end of the first year.

However, in examining subgroups with different farm backgrounds, Hanson found some significant differences in the quality point averages in college courses in basic sciences and in mathematics when he compared these averages with the amount of high school course work in science and mathematics. In general, the differences in these two areas of subject matter were in favor of the subgroups with the most high school science and mathematics.

Thomas (37) at Purdue University, in his Ph.D. dissertation which was completed in 1960, investigated the initial achievement of 603 male freshmen students who entered the School of Agriculture in the fall semesters of 1957 through 1959. With high school rank controlled, he compared the grade point indices of groups: (1) with no vocational agriculture in high school, (2) with 1 to 2 units of vocational agriculture, and (3) with 3 or more units in that curriculum. He found that students with no vocational agriculture had a significantly higher grade point index at the end of the

first semester than those in the other groups. However, at the end of the first year, he found no significant differences in the cumulative grade point indices of students in the three groups.

Thomas found that students with the most vocational agriculture had significantly higher marks than the other groups in an introductory animal husbandry course. However, he did not find significant differences in the marks of students in the three vocational agriculture groups in 9 other first-year college courses including algebra and chemistry.

When grouped with respect to background in high school subjects other than agriculture, Thomas found that students with more than 2 units in high school mathematics had the highest marks in college algebra and chemistry; those with more than 2 units in high school science had the highest marks in college chemistry, zoology, and farm mechanics; and those with more than 3 units in high school language arts excelled in college English composition.

The findings of Hanson at the University of Minnesota and Thomas at Purdue University as well as the findings of some of the previously mentioned Iowa researchers, suggest the desirability of encouraging high school students who may decide to enroll in an agricultural college to follow the vocational agriculture program of studies suggested in Appendix I. This suggested high school program provides for 3 years of Science in addition to 4 years of vocational agriculture.

## Achievement in Basic Science Courses

Information is provided in two studies which were conducted at Iowa State University concerning achievement of former vocational agriculture students in basic science courses. The one involved a beginning botany course and the other a beginning chemistry course. Both of these studies were limited to the achievement of students who had enrolled in the College of Agriculture.

### Botany

Carter (9) in his M.S. thesis, studied the effectiveness of vocational agriculture as preparation for the beginning course in botany. His sample included 224 students who had entered the College of Agriculture in the fall quarters of 1947 through 1948. Half had submitted three or more entrance credits in vocational agriculture and the other half had less than three, or no credits in this subject.

In his study of the marks received in the beginning botany course, Carter computed an analysis of covariance using as controls the American Council on Education Psychological Examination scores and first quarter English marks. He found a highly significant difference in the average final marks received in the botany course by students in the two groups. The former students of vocational agriculture excelled by one-third of a letter mark. It was concluded that the apparent advantage possessed by this group might be attributed to factors related to instruction and experience received in the vocational agriculture program.

## Chemistry

Betts (4) investigated the probability of attrition-survival of students in a beginning chemistry course, in his M.S. thesis at Iowa State University. He studied the records of 287 male students who had enrolled in the College of Agriculture in the fall quarter of 1950. At that time all students who scheduled beginning chemistry were enrolled in Chemistry 101 regardless of whether they had taken chemistry in high school.

For the purposes of his study, Betts defined attrition as including students who dropped out of college prior to enrollment in Chemistry 101, as well as those who transferred to a decelerated course in chemistry, or who received a failing mark in Chemistry 101.

When tables of survival probability were prepared, using high school averages and American Council on Education Psychological Examination scores as bases for prediction, little difference in probability of survival in Chemistry 101 was found when those who had taken vocational agriculture in high school were compared with those who had not. However, the tables indicated that students who had taken chemistry in high school had a greater chance of survival in the beginning college course in chemistry than students without high school chemistry.

Separate sections, Chemistry 101A or 102A, are now provided for students who have had high school chemistry. Chemistry 101 and 102 are taken by students who have not had chemistry in high school. However, there are some indications that it would be desirable for students in the vocational agriculture curriculum to take high school chemistry as recommended in the suggested plan of studies (Appendix I).

## Achievement in Agricultural Engineering Courses

Three Iowa studies of achievement in the College of Agriculture of students in agricultural engineering courses involved information concerning the marks of vocational agriculture graduates in the beginning farm mechanics course (A.E. 254). One of these studies also included information concerning marks in three other agricultural engineering courses and final cumulative averages in all college courses.

### Beginning farm mechanics

O'Brien (29), in his M.S. thesis, investigated the effectiveness of vocational agriculture and industrial arts as preparation for the beginning course in farm mechanics (A.E. 254) at Iowa State University. He obtained the records of 184 freshmen students with farm backgrounds who had entered the College of Agriculture in the fall quarters of 1946 through 1948.

An analysis of marks in the beginning farm mechanics course, using American Council on Education Psychological Examination scores and first quarter English marks as bases for statistical predictions, showed that the former vocational agriculture students had received marks which averaged one eighth of a letter mark higher than those predicted for them. Students who had taken industrial arts in high school received marks which were on an average one fifteenth of a letter mark lower than predicted.

Students who had taken neither vocational agriculture nor industrial arts received marks which averaged one fourth of a letter mark lower than predicted. The differences, which were in favor of the former students of vocational agriculture, were significant at the 5 per cent level.

In his M.S. thesis, Fulton (16) collected data from 237 students who had been enrolled in the beginning farm mechanics course (A.E. 254) at Iowa State University in the fall quarter, 1955 and the winter quarter, 1956. By a random sampling technique he selected a sample of 100 students who had studied vocational agriculture 3 or more years and 100 who had not been enrolled in any courses in vocational agriculture. A questionnaire was used to acquire information concerning the experience of the students in various farm mechanics skills prior to enrollment in the course.

Fulton stratified each group according to where the skills had been used. An analysis of the data indicated that participation in vocational agriculture had a high positive correlation with skills used in the area of farm mechanics included in A.E. 254 prior to the students' enrollment in that course. A comparison of the mean marks of the former vocational agriculture students with those of the nonvocational group showed a positive correlation, which was significant at the 5 per cent level, in favor of the former vocational agriculture students.

Stevenson's M.S. thesis (36) at Iowa State University involved a study of farm mechanics practices used by 371 students who were enrolled in the beginning farm mechanics course (A.E. 254) before they had enrolled for this course. The students were enrolled during the academic year, 1955-56.

The former vocational agriculture students who were included in Stevenson's study had fewer farm shops on their home farms than members of the nonvocational agriculture group. However, the former vocational agriculture students had used more farm mechanics tools and had performed more farm mechanics jobs than members of the other group. Although Stevenson's study did not include a comparison of the mean marks in the A.E. 254 course, it is of interest because it provides more specific information than was provided in the previously mentioned studies by O'Brien and Fulton concerning the experience in farm mechanics jobs acquired by former vocational agriculture students prior to enrollment in the college course in beginning farm mechanics.

Other agricultural engineering courses

Hoerner (20), in his M.S. thesis which was completed at Iowa State University in 1963, studied the records of 251 male students who entered the freshman class in the fall of 1955 and who had taken one or more of four selected college courses in agricultural engineering. The four courses which included the beginning course (A.E. 254) were either required or frequently elected in the agricultural education curriculum and in some other curricula in the College of Agriculture.

Hoerner's investigation included information concerning the semesters of high school vocational agriculture, of high school mathematics, of high school physics, and of high school chemistry. He also obtained high school quality point averages, mathematics placement scores, marks in the four

agricultural engineering courses, third quarter college quality point averages, and final college quality point averages.

No significant relationships were found by Hoerner between semesters of high school vocational agriculture and semesters of high school mathematics or chemistry. However, he found that a highly significant negative relationship existed between the semesters of vocational agriculture and the semesters of high school physics. This negative relationship indicated a tendency for the students to substitute vocational agriculture for physics in the high school curriculum or physics for vocational agriculture.

Positive correlations, significant at the 5 per cent level, were found between semesters of vocational agriculture and each of three measures of achievement in college: (1) Third-quarter point averages, (2) final college quality point averages and (3) marks in the beginning course in agricultural engineering, Metal Fabrication (A.E. 254). No significant relationships were found between high school vocational agriculture and marks in three other agricultural engineering courses; namely, Wood and Concrete Construction (A.E. 255), Farm Power and Machinery (A.E. 334), and Soil and Water Conservation (A.E. 306).

Hoerner found that semesters of vocational agriculture and semesters of high school mathematics each yielded a positive correlation, significant at the 5 per cent level, with final college quality point average. However, semesters of high school chemistry and of high school physics each yielded a nonsignificant correlation when compared to final college quality point averages. In comparing semesters of high school credit in certain courses with tendency to graduate from college, it was found that students who were graduated had completed .45 more mean semesters of vocational agriculture and .38 more of high school mathematics than the students who were not graduated from college. The differences in mean semesters of high school physics and chemistry were only .16 and .04 respectively in favor of the students who were graduated.

## Achievement in Other Areas of Technical Agriculture

In addition to the aforementioned studies involving achievement of vocational agriculture graduates in agricultural engineering courses, four Iowa M.S. studies and two recent doctoral dissertations, the one at the University of Minnesota and the other at the University of Missouri, have also dealt primarily with achievement in certain areas of technical agriculture.

### Poultry science

In his M.S. thesis, Gamble (17) investigated the records of 164 students who had entered the College of Agriculture at Iowa State University in the fall quarters of 1946 through 1948 and who had enrolled in the beginning course in poultry production. He compared the mean marks received by students who had submitted entrance credits for three or more years of vocational agriculture with the marks of those who had received credit for less than three years of vocational agriculture.

As controls on scholastic aptitude and ability, Gamble used scores obtained in the American Council on Education Psychological Examination and the final marks received in the first quarter college course in English. Using these controls, analysis of covariance was computed. No significant difference was found between the marks of the vocational agriculture and the nonvocational agriculture graduates in the beginning poultry science course. A comparison was also made of the marks of students with farm and nonfarm backgrounds. No significant difference was found in the final marks of students grouped on this basis.

Dairy industry

Drake (15), in his M.S. thesis, compared the records of 256 vocational agriculture and nonvocational agriculture graduates who had entered the College of Agriculture at Iowa State University in the fall quarters of 1946 and 1947 and who had completed a beginning course in dairy industry (D.I. 114).

Using as controls the American Council on Psychological Examination scores and final marks in the beginning college course in English, Drake computed analysis of covariance. No significant difference was found between the vocational agriculture and the nonvocational agriculture graduates in the final marks received in the beginning course in dairy industry.

In his comparison of the final marks of students with farm and nonfarm backgrounds, Drake found that the students with farm backgrounds received marks that were three-eighths of a letter mark higher than those of the nonfarm group. This difference was highly significant.

Animal science

In 1963, Bendixen's M.S. thesis (3) included information concerning achievement in animal science courses of 321 male students who had entered the freshman class in the College of Agriculture, Iowa State University the fall quarter of 1955. He found a positive correlation which approached statistical significance between semesters of high school vocational agriculture and quality point averages in two introductory animal science courses (An.S. 111 and An.S. 112). No significant relationship was found between semesters of high school vocational agriculture and achievement in advanced animal science courses.

Bendixen found evidence in his study that there had been a tendency for high school students to substitute vocational agriculture for science, or science for vocational agriculture in their high school curricula. He found no significant relationship between semesters of high school vocational agriculture and the American Council on Education Psychological Examination scores, English placement test scores, mathematics placement test scores, first quarter college quality point averages, final cumulative college point averages, or tendency to graduate from college.

In his Ph.D. dissertation at the University of Minnesota, Deboer (10) investigated the scholastic achievement of 236 students who were enrolled in a beginning dairy husbandry course and a beginning animal husbandry course in the College of Agriculture during the fall and winter quarters of the 1957-58 school year. He classified those with three or more years

of high school vocational agriculture as a "vo-ag" group and others as "nonvo-ag". He also selected a group with "high" farm experience and another with "low" farm experience. He used the American Council on Education Psychological Examination scores and high school percentage ranks as controls. Measures of achievement were taken both at the beginning and upon the completion of the courses.

Deboer found differences in scholastic achievement significant at the 5 percent level between the "vo-ag" and the "nonvo-ag" groups in favor of the former in both the beginning dairy husbandry and the beginning animal husbandry classes in the fall quarter. Differences significant at the 5 percent level in favor of the "high" farm experience group as compared with the "low" group were found in all classes each quarter.

In view of the results of his study, Deboer concluded that consideration should be given to: (1) encouraging certain individuals in the "vo-ag" and "high" farm experience groups to take an exemption examination or an examination for credit after further preparation, and (2) encouraging certain individuals in the "nonvo-ag" and "low" farm experience groups to gain some experience related to the courses before enrolling in them.

Agronomy

Information is provided in McCracken's M.S. thesis (28) concerning the achievement of vocational agriculture graduates in two beginning and two advanced agronomy courses at Iowa State University by 309 students who had entered the freshman class in the fall quarter of 1955. His thesis was completed in 1962. McCracken investigated first quarter, third quarter, and final quality point averages, and also tendency to graduate from college as measures of achievement. These and other variables including high school averages, American Council on Education Psychological Examination scores, mathematics placement scores, and English placement scores were arranged on a fourteen variable matrix and processed through an electronic computer to obtain intercorrelations.

No significant relationship was found by McCracken between semesters of high school vocational agriculture and achievement in any of the agronomy classes included in his investigations or achievement in college as indicated by the various measures. However, he found that in no instance was the number of semesters of high school vocational agriculture negatively correlated with achievement in agronomy courses or with academic achievement in college. High school quality point average appeared to be more highly related to achievement in agronomy courses than any other variable available to counselors at the beginning of the student's college career.

In his recent doctoral dissertation, Beeks (2), at the University of Missouri, investigated pre-college experiences as preparation for college courses in agronomy. A pretest covering material presented in two beginning courses, Field Crops I and Introduction to Soil Science, was administered to 310 entering freshmen students during the years 1962 and 1963. Scores were obtained for each student on the School and College Ability Test. The study included information concerning the farm background and the 4-H experience of the students as well as their experience in vocational agriculture. More than half of the students had taken more than one year of vocational agriculture in high school.

Beeks found that students in his sample with various kinds of agricultural experience received significantly lower mean scores on the School and College Ability Test than those without agricultural experience. However, about 48 per cent of the former students of vocational agriculture scored above 70 per cent on the beginning agronomy examination. Only 9 per cent of students in the nonvocational agriculture group scored above 70 per cent.

Beeks concluded that a substantial number of students had demonstrated the ability necessary to be granted credit in beginning agronomy courses, if a program had been provided permitting the granting of credit by special examination. He stated that granting such credit by examination would allow the College to compete more successfully than at present for superior students. He also stated that if students received credit by special examination in beginning courses, they should be encouraged to take advanced courses in the same fields. Beeks pointed out that this procedure would result in an enrichment of the programs of the students.

## DISCUSSION--SIGNIFICANCE OF FINDINGS

In Iowa, 10,499 different students were enrolled in high school vocational agriculture classes in the 248 four-year high schools which offered the curriculum during the 1964-65 school year (14). Information is not available concerning the percentage of farm-reared boys in these high schools who elected courses in vocational agriculture, nor concerning the number of farm boys enrolled in Iowa high schools which do not offer vocational agriculture. However, information is at hand which serves as a basis for estimating the extent to which vocational agriculture is available to boys who would likely be interested in enrolling if the curriculum were offered in all high schools.

### Enrollment and Estimated Potential Enrollment in Vocational Agriculture

The table given in Appendix II is adapted from information which was given in the February, 1963 newsletter from the Iowa Division of Vocational Education to vocational agriculture instructors (11). It provides data concerning the enrollment during the 1962-63 school year in the vocational agriculture curriculum in Iowa high schools grouped according to size of school. Also, the estimated potential additional enrollment in vocational agriculture is shown for schools in each group which did not offer the curriculum that year. The estimated total potential additional enrollment (7410) is based on the assumption that if vocational agriculture had been offered, the percentage of students electing this curriculum would have been the same as the percentage of students who had elected it in schools of the same size group which offered the curriculum.

On this basis, it may be calculated from data shown in the table that the total enrollment in vocational agriculture in the 1962-63 school year (10,499) was 58.6 per cent of the enrollment which might have been expected if all high school students in the state had had an opportunity to elect the curriculum.

#### Census data concerning rural farm students enrolled in high school

According to the 1960 U.S. Census of Population (42), 45,302 boys and girls from rural farm families in Iowa attended grades 9 to 12 in public high schools between February 1 and April 1 of that year. During the 1959-60 school year, 10,478 students were enrolled in vocational agriculture in 285 four-year high schools in Iowa which offered this curriculum (44). If it is assumed that one-half of the 45,302 high school students from rural farm families in Iowa were boys and that no town boys and no girls had elected vocational agriculture, then 10,478 divided by 22,651 or 46.3 per cent of all boys from rural farm families in Iowa attending public high schools that year may have been enrolled in vocational agriculture.

However, the previously presented estimate; namely, that Iowa high schools were reaching 58.6 per cent of the total present and potential additional enrollment in vocational agriculture in the 1962-63 school year, probably gives a better indication than the figure based on the census data of the extent to which Iowa schools are meeting the need for this curriculum. The estimate based on the percentage of students enrolled in vocational agriculture in high schools of the various size groups provides a weighted average which probably reflects differences in the extent to which boys in the smaller rural high schools tend to elect this curriculum as compared with boys in larger urban schools.

It should be noted that the percentage of the total farm boys in Iowa who are actually enrolled in vocational agriculture is doubtless somewhat higher today than it was during the 1962-63 school year. According to information from the U.S. Farm Census reports and from the Iowa Crop and Livestock Reporting Service, the number of farms in Iowa decreased from 175,000 in 1960 to 161,000 in 1966. However, the enrollment in high school vocational agriculture classes during that period remained approximately the same. (The enrollment was 10,478 during the 1959-60 school year and 10,499 during 1964-65.)

A comparison of enrollment in Iowa and Illinois

Kreb's (24) finding that 71 per cent of the entering freshmen in agriculture at the University of Illinois from 1954 through 1957 had been enrolled in vocational agriculture is of interest in connection with investigations concerning the percentage of farm boys enrolled in this high school curriculum in Iowa. As previously mentioned, during recent years, approximately 50 per cent of entering freshmen in the College of Agriculture at Iowa State University had been enrolled in vocational agriculture. The fact that 71 per cent of freshmen in Illinois had studied vocational agriculture suggests that a larger proportion of farm boys in Illinois may have had an opportunity to enroll in this curriculum than had been true of farm boys in Iowa

Table 2, Number of farms and enrollment in high school vocational agriculture, Iowa and Illinois[a]

| | Year | Iowa | Illinois |
|---|---|---|---|
| No. farms (U.S. Census) | 1959 | 174,707 | 154,644 |
| Avg. size of farms (acres) | 1959 | 194 | 196 |
| Enrol. H.S. Voc. Agr. | 1959-60 | 10,478 | 15,019 |
| No. Voc. Agr. Depts. | 1959-60 | 285 | 447 |
| No. of farms per students enrolled in Voc. Agr. | 1959-60[b] | 16.7 | 10.3 |

[a]Data from 1959 U.S. Census of Agriculture (41) and Annual reports of State Boards for Vocational Education (44).

[b]During the 1964-65 school year, in Iowa the number of farms per student enrolled in vocational agriculture was approximately 15.2. The number of farms had decreased to 161,000 in 1966, while the number of high school vocational agriculture students had increased slightly (10,587 during the 1964-65 school year).

As shown in Table 2, Illinois had 154,644 farms averaging 196 acres in size in 1959; whereas, Iowa had 175,707 farms averaging 194 acres that year (41). However, during the 1959-60 school year, Illinois had 447 departments of vocational agriculture enrolling 15,019 high school students; but in Iowa, that year there were only 285 departments enrolling 10,478 students (44). Obviously, a much larger percentage of the farm boys in Illinois were enrolled in vocational agriculture than was the case in Iowa.

Two important reasons why Iowa does not have more departments of vocational agriculture are: (1) that many high schools are too small to justify employment of a full-time teacher of vocational agriculture and (2) there has been a serious shortage of qualified teachers in this field.

## Follow-up Studies of Education and Employment

As previously mentioned (page 1), 27.5 per cent of the vocational agriculture graduates in Iowa in the spring of 1964 were enrolled for full-time instruction in a college or in some other educational institution within six months after graduation. Other studies have provided additional information of interest concerning the educational and occupational plans, decisions, and experiences of vocational agriculture graduates and of other farm-reared high school students.

A study by Burchinal and others (8) included information concerning the educational plans of 860 Iowa farm boys who were seniors in high school in 1959. The statewide sample included farm boys in schools which offered vocational agriculture and boys from schools which did not offer this curriculum. Only 17 per cent of the farm boys who expected to farm planned to enter college. However, nearly half of the farm boys who expected to enter nonfarming occupations planned to enroll in a college level institution.

### A 12-county survey of former high school students

In 1961, Howe (21) conducted a survey of high school graduates and dropouts from all of the 88 high schools in a block of 12 predominantly rural northcentral and northeastern Iowa counties. He sent questionnaires to 2,440 former students in these schools who had been enrolled in the ninth grade during the three school years, 1952-53, 1954-55, and 1956-57. This sampling constitutes about one fourth of the total enrollment in the ninth grade in the 88 high schools during that period. About three fourths of the former students in the sample returned the questionnaires.

Many of the 88 schools in the 12 counties did not offer vocational agriculture during the period of the study. However, about 75 per cent of the farm-reared respondents had been enrolled in such classes. Of the former students who were farming when the survey was made, 60 per cent had received training in vocational agriculture.

### A state-wide study of farm-reared male high school graduates

Robinson (33), in his Ph.D. dissertation, secured information about education beyond high school and about employment in 1963 of the 6096

former students of vocational agriculture and other farm-reared male graduates from 165 Iowa high schools which offered vocational agriculture. The former students had been graduated from high school 9 to 13 years earlier during the period from 1950 through 1954.

Although vocational agriculture was offered in all of the 165 schools included in Robinson's study, 13 per cent of the graduates in his sampling were farm-reared males who had not elected any courses in vocational agriculture. The other 87 per cent had studied vocational agriculture. In his entire sample, Robinson found that employment in 1963 (9 to 13 years after graduation) was as follows: farming, 31.6 per cent; off-farm agricultural occupations, 13.1 per cent; and nonagricultural occupations, 55.1 per cent.

Of the respondents who were farming in 1963, Robinson found that only 15.6 per cent had attended a college or junior college. However, of the respondents who were engaged in nonfarm agricultural occupations and in nonagricultural occupations, 38.7 and 40.3 per cent respectively, had attended a college level institution. The study disclosed that 32.5 per cent of all 6096 respondents had been enrolled in a college or junior college at some time after the survey was made.

Because Robinson's sampling consisted of vocational agriculture and other farm-reared graduates, his finding that 32.5 per cent of his respondents had been enrolled in a college level institution is of interest in connection with a finding by Howe (21) in his previously mentioned follow-up study of former ninth-grade students. Howe found that 29 per cent of the former farm-reared male students who had completed high school reported that they had been enrolled in a college or junior college the first year after graduation. However, of the nonfarm male students in Howe's study, 45 per cent had been enrolled in such institutions.

Of the 2093 high school graduates in Robinson's study who had been enrolled in a college or university after their graduation, 550 had been enrolled in a college of agriculture. There are indications that an increase has occured since the time of Robinson's study (1963) in the percentage of vocational agriculture graduates who continue their education in a college of agriculture. In the fall of 1964, there were 537 entering freshmen in the College of Agriculture at Iowa State University. As previously mentioned (page 1), 1,942 vocational agriculture students were graduated from Iowa high schools in the spring of 1964. We may assume that the number of vocational agriculture graduates from other states entering Iowa State was equal to the number of Iowa graduates from this curriculum entering colleges of agriculture in neighboring states. Also, we may assume that about one half of the 537, or 268, of the entering freshmen at Iowa State in 1964 were vocational agriculture graduates.

On a basis of the foregoing assumptions, it would appear that 268, or approximately 14 per cent of the 1,942 vocational agriculture students who were graduated in the spring of 1964, enrolled in a college of agriculture in the fall of that year. It was reported (page 1) that 535, or 27.5 per cent, of the vocational agriculture graduates in the spring of 1964 had continued their education in a college or in some other full-time educational institution, by December of that year. Therefore, it may be

estimated that approximately one-half of the vocational agriculture graduates who continued their education beyond high school enrolled in an agricultural college.

The educational level of rural farm males

Data from the United States Census of Population is of interest in connection with the previously mentioned investigations which show that a relatively small percentage of vocational agriculture graduates, farm-reared graduates, and graduates who became farmers had enrolled in college as compared with the percentage of high school graduates in other categories who had continued their education in college.

According to the U.S. Census of Population of 1960 (42), in Iowa the median school years completed by the rural farm male population 25 years of age and older was 9.0. For the urban male population of the same age, it was 11.4 school years. No doubt this difference is decreasing because a larger percentage than formerly of farm boys are now continuing their education in high school. However, it is apparent from the findings in the aforementioned studies that the percentage of farm-reared male graduates who continued their education in college in recent years was very low as compared with the percentage of town boys who did so. This was especially true of high school graduates who became farmers.

This situation is of concern to everyone who is interested in the economic, social, and cultural welfare of the farm population. It should also be of concern to everyone interested in the welfare of the urban population and of the society as a whole. Large numbers of persons migrate from farm to city and of course the maximum development of all segments of the population is essential to the fullest development of the state and nation.

## Measures of Achievement in College

Various measures of achievement have been used in the studies of the success of vocational agriculture graduates in college which are summarized in this report. Most of the investigations involved measures of scholastic achievement.

Scholastic achievement

Scholastic achievement was usually measured in terms of marks received in specific classes, in averages of marks received in certain subject matter areas, or in cumulative averages of marks received at the end of certain periods or at graduation. In some studies scholastic achievement was measured in terms of the percentage of entering students who re-enrolled for certain terms or certain years, or who were graduated within a certain period.

Although measures of scholastic achievement in college are, no doubt, of primary importance, it is unfortunate that Iowa studies have not included some measures of accomplishment in other areas of college activities. Objectives of the Future Farmers of America, the organization of high school students of vocational agriculture include the development of leadership ability and the ability to participate effectively in group activities.

In the comprehensive Eight-Year Study (46) it was found that students

who had not followed the traditional high school curriculum participated more in college activities and earned higher percentage of nonacademic honors than students in the other group.

Achievement in college and community activities

Although Iowa studies did not include information concerning participation of vocational agriculture graduates in college activities, studies that have been reported in three other states have included such information. Pumper (32) at the University of Wisconsin and Kennedy (23) at Washington State University each found that vocational agriculture graduates participated to a greater extent than nonvocational agriculture graduates in leadership activities. On the other hand, Macomber (26) in his comparison of 50 pairs of students at Cornell University did not find significant differences between those with and those without vocational agriculture in the extent to which they engaged in college extracurricular activities.

Two studies in Iowa provided some information concerning participation of former students of vocational agriculture in community activities. Archer (1), in his M.S. thesis studied the extent of participation in organized activities by a sample consisting of 120 young farmers who had completed three or more years of vocational agriculture and had been graduated from 19 central Iowa high schools which offered this curriculum. His control group consisted of 120 young farmers who had been graduated from 19 central Iowa schools which had not offered vocational agriculture. The high schools were paired on a basis of a number of social and economic factors before the names of the students were drawn by a random sampling procedure.

The young farmers included in Archer's study had been graduated during the years 1938 through 1952. He examined the extent to which they had assumed membership and leadership responsibilities at the time of his survey (1955) in 27 organizations and organized group activities commonly found in central Iowa communities. He found a difference in the two groups which was significant at the 1 per cent level. The difference was in favor of the former vocational agriculture students.

As one phase of a broader study, Blake (7), in his doctoral dissertation at Iowa State University, investigated the relationship of high school training in vocational agriculture to subsequent participation in organized groups in rural communities. The 320 young farmers in his sample had been graduated during the years 1943 through 1954 from 20 pairs of high schools in the area which offered vocational agriculture during the period were paired with 45 schools which did not offer this curriculum but which were located in communities in which a number of social and economic factors were similar. The 20 pairs of schools in the sample were randomly drawn from the 45 pairs in the area. The names of the 160 students in each of his two groups were drawn at random from each school in the 20 pairs of schools.

In his follow-up study of the young farmers in 1963, Blake found that vocational agriculture graduates had participated and had held leadership positions in farm organizations to a greater extent than the nonvocational agriculture graduates. However, on a basis of his findings, he suggested that additional emphasis in the vocational agriculture program should be placed upon the objective of enabling students to obtain a better understanding of the basic objectives of farm cooperatives, other farm organizations, and church groups.

## Implications

The findings of the studies summarized in this report have important implications for college and high school administrators, faculty members, and guidance personnel. Questions frequently arise concerning guidance of high school students who are interested in agriculture and who may enter an agricultural college or some other college. Also, questions arise concerning the admission policy of colleges and concerning the subject matter to be offered in beginning college courses in technical agriculture for students with a background in vocational agriculture.

Studies of achievement of vocational agriculture graduates in college support the viewpoint that, in general, students who select the vocational agriculture curriculum in high school and continue their education in college, probably will succeed just as well in college as the students with equal ability who select some other high school curriculum. In fact, a number of studies indicate that the vocational agriculture graduates tend to get along a little better in colleges of agriculture than those who take some other pattern of studies in high school.

There are indications that students who have had advanced courses in high school mathematics, and in high school science tend to have some advantage in beginning college courses in these subject areas. The typical vocational agriculture graduate may have had somewhat less courses in mathematics and perhaps in science than graduates of other high school curricula. However, the studies indicate that vocational agriculture graduates generally have enough advantage as compared with other graduates, in some courses in technical agriculture to offset, or more than offset, any disadvantages that they might encounter in beginning college courses in mathematics or science.

On a basis of the findings in his study, Deboer (10) recommended that certain students with vocational agriculture training who enter the University of Minnesota be encouraged to take an exemption examination or an examination for credit in beginning college courses in dairy husbandry and animal husbandry. Beeks (2), in his doctoral dissertation at the University of Missouri, recommended that consideration be given to making provision for similar examinations in beginning courses in crops and soils. Beeks suggested that students who pass such examinations could enrich their programs by taking more advanced courses in the area than they would otherwise have been able to schedule.

### Recommendations concerning high school curricula

Associate Dean Thompson of Iowa State University, in an article in the Agricultural Education Magazine (38), wrote that he would strongly recommend enrollment in vocational agriculture if a high school student is planning a career in agriculture or in an agriculturally related occupation and is looking forward to college. He pointed out that his studies of entering freshmen in the College of Agriculture at Iowa State University and numerous other studies have shown no significant differences in college grades between students who had backgrounds in vocational agriculture in high school and students who had no vocational agriculture.

Thompson recommended that students who plan to enroll in college, elect advanced courses in high school science and mathematics in addition to vocational agriculture. However, he pointed out that college-bound

students should not be counseled out of vocational agriculture into science and mathematics. He recommended that a combination of these subjects be taken rather than that they become competitive in the case of students preparing for college entrance. The suggested program of studies for college bound students which is given in Appendix I includes advanced courses in mathematics and science as well as four years of vocational agriculture.

In another article, Thompson (39) stressed the value of vocational agriculture in maintaining or developing interest in a college education in agriculture. He stated that if the student has the potential to complete college, the teacher of agriculture is the one most likely to help him to develop an interest in and an acquaintanceship with an agricultural college.

## SUMMARY

Some recent studies have indicated that less than one-third of the graduates of high school departments of vocational agriculture in Iowa have continued their education by enrolling in college. Although many of these graduates enroll in other colleges or in junior colleges, approximately one half of the entering freshmen in the College of Agriculture at Iowa State University have been enrolled in vocational agriculture in high school.

High school students who are contemplating careers in agriculture or in occupations related to agriculture and who may decide to enroll in college, as well as the advisors of such students, are interested in information concerning the achievement of vocational agriculture graduates in college.

In general, research studies support a recommendation that is made by many leaders in agricultural education and by many student counselors, namely, that students with interest and experience in agriculture who have an aptitude for college work should be encouraged to enroll in the four-year vocational agriculture program in high school and also should elect advanced courses in high school mathematics and science. A suggested program of studies which provides such a combination of courses is given in Appendix I.

The studies reviewed in this report and two earlier summaries (35 & 40) that were made of studies throughout the United States indicate that students who were enrolled in vocational agriculture in high school, generally do as well or better in colleges of agriculture than do students who did not enroll in vocational agriculture. Also, studies of vocational agriculture graduates who entered other colleges, instead of colleges of agriculture, indicate that such graduates usually do as well as the nonvocational agriculture graduates.

Most of the 16 studies of the achievement of vocational agriculture graduates at Iowa State University and most of the studies from other states reviewed in this report have included some method of statistical treatment to indicate whether differences found in the achievement of groups are significant.

A number of Iowa studies and three studies conducted in neighboring states have provided information concerning the achievement of vocational agriculture graduates in several courses taken during the freshman year, or in all courses taken in colleges of agriculture.

In both his M.S. and Ph.D. studies at Iowa State University, Bicknell (5 & 6) found that students in his samples who had been enrolled in vocational agriculture programs did better than those with other high school curriculum patterns, when their achievement was measured in terms of first quarter quality point averages in the College of Agriculture. In his dissertation, Bicknell (6) also found that a high school pattern which included a total of six or more units in high school mathematics and science apparently was the most effective when measured in terms of re-enrollment in the sophomore class of the College of Agriculture.

Schmidt (34) found, in his sample of 287 students, that the number of semesters of high school vocational agriculture was positively correlated at the 1 per cent level with both first quarter and final college quality point averages in the College of Agriculture at Iowa State University. He found no correlation between semesters of high school science and quality point averages.

Hoerner (20) studied the scholastic achievement of 251 students who had been enrolled in agricultural engineering courses at Iowa State University that are frequently taken by students in the College of Agriculture. His study included a comparison of the number of semesters taken in certain high school subjects with final quality point averages in all subjects in the College of Agriculture. He found that in his group of students, the semesters of vocational agriculture and the semesters of high school mathematics both yielded positive correlations significant at the 5 per cent level with final college quality point averages in all subjects. However, semesters of high school chemistry and of physics each yielded nonsignificant correlations with final scholastic averages.

Krebs (24), of the University of Illinois staff, in his study of 836 entering students, found that students with the most entrance credits in vocational agriculture tended to earn slightly higher grades in the College of Agriculture than students with the least number of credits or no credits in this subject area. Also, there were less drop-outs from the former than from the latter group. He found no significant relationship between units in high school mathematics or in high school science and grade point averages in the College of Agriculture.

In his study of achievement of 395 students in the College of Agriculture at the University of Minnesota, Hanson (18) found no significant differences in the quality point averages of students either at the end of the first quarter or at the end of the first year, and levels of course work in high school vocational agriculture, in high school mathematics, or in high school science. However, when students were stratified on bases of farm and nonfarm backgrounds and on veteran and nonveteran experience, Hanson found some significant differences in some subgroups in the levels of high school course work and scholastic achievement in certain college subjects. In general, subgroups with a high level of course work in high school mathematics and science excelled subgroups with lower levels of such course work when the groups were compared on bases of quality point averages in basic courses in college mathematics and science.

At Purdue University, Thomas (37) investigated the initial achievement in the School of Agriculture of 603 entering freshmen. With high school rank controlled, he found a significant difference in first semester grade point indices in favor of the nonvocational agriculture group. However, no significant differences were found in cumulative grade point indices at the end of the first year.

Thomas found that students with the most vocational agriculture

had significantly higher marks than those in the other groups in a beginning animal husbandry course. He found no significant differences between the groups in nine other beginning college courses. In another grouping of his students, Thomas found that students with more than 2 units of credits in high school mathematics excelled in college algebra and chemistry. Those with more than 2 units in high school science excelled in college chemistry, zoology, and farm mechanics. Those with more than 3 units in high school English excelled in college English composition.

Eight studies have been made at Iowa State University which were primarily concerned with achievement of students with and without vocational agriculture in certain beginning courses that are currently offered in the College of Agriculture. In five of the studies involving marks received in four beginning courses, differences were found in favor of the groups with training in vocational agriculture. However, in three studies involving four other beginning courses, no significant differences were found in marks of students with and without vocational agriculture.

In his study of the marks of 224 students in a beginning course in botany, Carter (9) found a highly significant difference in favor of the vocational agriculture group. In three separate studies by O'Brien (29), Fulton (16), and Hoerner (20), each found differences significant at the 5 per cent level in favor of vocational agriculture groups in the average marks of their samples of students in a beginning course in agricultural engineering. Bendixen (3), in his M.S. thesis, found a difference approaching significance in favor of the vocational agriculture group in the average marks received by 321 students in two beginning animal science courses (An.S. 111 and An.S. 112).

Deboer (10), at the University of Minnesota, found significant differences in achievement in favor of vocational agriculture groups as compared with nonvocational agriculture groups in some classes in a beginning animal husbandry course. He measured achievement both at the beginning and at the end of the courses. He concluded that consideration should be given to encouraging certain individuals with vocational agriculture experience and a high level of farm experience to take exemption examinations or examinations for credit in these courses.

The three Iowa State University studies in which no significant differences were found between the marks of students with and without training in vocational agriculture were made by Gamble, Drake, and McCracken. Gamble found no significant differences in the marks of students in the two groups in a beginning course in poultry science. Drake (15) found no differences in a beginning course in dairy industry and McCracken (28) found no differences in the average marks of the two groups in either of two beginning courses in agronomy (Agron. 114--crops, and Agron. 154--soils).

In connection with McCracken's finding, a report by Beeks (2) at the University of Missouri is of interest. He found that vocational agriculture graduates received much higher marks than nonvocational agriculture graduates in a pretest covering course materials taught in a beginning course in crops and a beginning course in soils at that

institution. He recommended that students be permitted to receive credit in these courses by examination and that those who receive such credit be encouraged to take advanced courses in the same fields.

Several of the studies which have been reviewed in this report have provided information concerning achievement of vocational agriculture graduates who had enrolled in other colleges as well as the achievement of those who had enrolled in colleges of agriculture.

Lathrop's study (25) included a comparison of the achievement of a sampling of 1516 students in all colleges at Iowa State University except Veterinary Medicine. He found that the students who had followed a mathematics-science pattern of courses in high school (a total of 6 or more units in mathematics and science) had a better chance of remaining in college beyond the first quarter than students who had followed the usual vocational agriculture pattern or other patterns in their high school programs. However, it was found that the influence of the high school pattern was, to a large extent, minimized in later quarters.

Even in engineering, Lathrop found that when scores on a scholastic aptitude (ACE) test and high school averages were held constant, the high school pattern had little influence on graduation, on drop-out tendency, or on final cumulative quality point averages.

An investigation of the relationship of 16 variables to achievement of 2013 students in four colleges at Iowa State University was included in Hensel's dissertation (19). He found no significant relationships between the semesters of vocational agriculture and achievement in the various colleges. He found that the semesters of certain high school courses such as mathematics and science appeared to have a positive but variable correlation with achievement in the four colleges.

Pierce (31), in his study of 800 students at Ohio State University, found that the vocational agriculture graduates enrolled in five colleges at the University had taken an average of about one semester less mathematics but about the same amount of English, chemistry, and physics in high school as the nonvocational agriculture graduates. The vocational agriculture group had a slightly higher twelfth-quarter scholastic average in the College of Agriculture than the nonvocational agriculture group. Also, in the four colleges other than the College of Agriculture the twelfth-quarter scholastic average of vocational agriculture graduates was slightly higher than the average of students in the nonvocational agriculture group. The differences were not significant in either case.

In their staff study, O'Kelley and Lester (30) investigated the mean marks received during the freshman year by students who had entered the University of Georgia in the 1960-61 school year. Members of the vocational agriculture group had received significantly lower scores than those in the nonvocational agriculture group in certain entrance tests. But, in spite of the lower entrance test scores, no significant differences were found in the mean marks of students in the two groups either in the University or in the College of Agriculture.

Also, no significant differences were found in marks received in any of the specific courses investigated.

For many years vocational agriculture teachers and others have advised students who were interested in vocational agriculture and who might decide to enroll in college to take advanced courses in high school mathematics and science in addition to the four courses in vocational agriculture as suggested in Appendix I. However, there apparently has been a tendency for some students who have been enrolled in vocational agriculture to take somewhat less credits in science than the average number of credits taken in these subjects by college-bound students who have taken other high school curricula. There are indications that beginning courses in some college subjects may have been more difficult for such students than for high school students who followed a curriculum pattern which included more than the usual number of credits in mathematics and science.

However, there seems to be evidence that students who were enrolled in vocational agriculture in high school have had an advantage scholastically over the nonvocational agriculture graduates in some beginning college courses in agricultural subjects and also an advantage in at least one beginning course in basic science; namely, botany. Apparently this advantage has tended to offset, or, according to findings in some studies, has more than offset any disadvantage experienced by the typical vocational agriculture graduate because of a somewhat limited number of credits in high school mathematics and science.

In addition to considering the influence of vocational agriculture upon scholastic success in college, attention should be given to other possible advantages of enrollment in the vocational agriculture curriculum in high school. Some studies have indicated that vocational agriculture graduates have participated to a greater extent in leadership activities in college and in rural communities than nonvocational agriculture graduates.

Associate Dean Thompson (38) of Iowa State University has strongly recommended enrollment in vocational agriculture for the student who is planning a career in agriculture or in an agriculturally related occupation and who is looking forward to enrollment in a college of agriculture. He has recommended that such a student include advanced courses in high school mathematics and science in addition to the vocational agriculture courses in his curriculum. He has stated that if the student has the potential to complete college, the teacher of agriculture is the person most likely to help the student develop an interest in and an acquaintanceship with an agricultural college.

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## APPENDIX I

A suggested program of studies for boys enrolled in high school vocational agriculture who may enter a College of Agriculture[1]

**Grade Nine**

English I
Algebra
Biology
Vocational Agriculture I

**Grade Ten**

English II
Geometry
World History
Vocational Agriculture II

**Grade Eleven***

U. S. History
Advanced Algebra-Trigonometry
Vocational Agriculture III
Chemistry

**Grade Twelve***

English III or IV
Physics
American Government-Economics
Vocational Agriculture IV

* English III or IV, Personal Typing, and Driver Training should be scheduled as fifth subjects during sophomore, junior or senior years.

The above program includes:

4 units of English
3 units of Mathematics
3 units of Science
3 units of Social Studies
4 units of Vocational Agriculture
½ unit of Personal Typing
½ unit of Driver Training

[1]Prepared in 1963 by C. E. Bundy and other members of the staff in agricultural education at Iowa State University. Advanced courses in high school mathematics and science are not required for entrance in the various curricula at Iowa State University. However, from the start of the vocational agriculture program such courses have been recommended as electives for students in the vocational agriculture curriculum who may enter college as well as for other students who have the ability to do satisfactory work in the courses.

## APPENDIX II

Table 3. Estimated potential enrollment in vocational agriculture in the 469 approved four-year high schools by size of schools, 1962-63 school year[a]

| Size of high school | Schools offering vocational agriculture: Total schools in group | Schools offering vocational agriculture: Schools in group | Schools offering vocational agriculture: Total enrollment[b] | Schools offering vocational agriculture: Enrollment in Voc. Ag.[c] | | Schools not offering vocational agriculture: Schools in group | Schools not offering vocational agriculture: Total enrollment | Schools not offering vocational agriculture: Potential additional enrol. in Voc. Ag.[d] |
|---|---|---|---|---|---|---|---|---|
| Less than | (N) | (N) | (N) | (N) | (%) | (N) | (N) | (N) |
| 100 | 54 | 14 | 1141 | 383 | 33.5 | 40 | 3286 | 1100 |
| 100-199 | 195 | 95 | 14574 | 2972 | 20.4 | 100 | 14117 | 2878 |
| 200-299 | 98 | 66 | 16189 | 2743 | 16.9 | 32 | 7406 | 1255 |
| 300-399 | 38 | 31 | 10655 | 1519 | 14.3 | 7 | 2407 | 343 |
| 400-499 | 22 | 18 | 8047 | 864 | 10.7 | 4 | 1760 | 189 |
| 500-599 | 20 | 16 | 8642 | 767 | 8.8 | 4 | 2096 | 186 |
| 600-699 | 42 | 19 | 13380 | 1009 | 7.5 | 3 | 2661 | 201 |
| 1000 & above | 20 | 4 | 8005 | 224 | 2.8 | 16 | 44960 | 1259 |
| Total | 469 | 263 | 80634 | 10480 | | 206 | 78693 | 7410 |

[a]Adapted from information in a newsletter of the Iowa Chief, Agricultural Education (11) which was based in part on data from the Iowa Department of Public Instruction Bul. No. 11620-7861 RP.

[b]Total H.S. enrollment, columns 3 and 7, includes boys and girls.

[c]Enrollment in Voc. Ag., columns 4 and 5, does not include enrollment in young and adult farmer classes.

[d]Estimated potential additional enrollment in vocational agriculture, column 8, was found for high schools in each size group by multiplying the total high school enrollment in schools not offering vocational agriculture (column 7) by the percentage (column 5) of total students who were enrolled in vocational agriculture in schools offering this curriculum.